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Department of Permitting Services
Permit # STORMWATER-282967
Date 05/30/17
Stamped By: Mark Etheridge

# ENGINEERING REPORT

## SAFE ROUTES TO SCHOOL
## SIDEWALK IMPROVEMENT PROJECT
## GARRETT PARK, MARYLAND

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FOR

Reviewed for Sediment Control and Stormwater Management by Thomas E. Weadon

**THE TOWN OF GARRETT PARK**
**4600 WAVERLY AVENUE**
**GARRETT PARK, MD 20896**

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PROFESSIONAL CERTIFICATION: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.

LICENSE NO.:_31168_____EXPIRATION ___1/12/2019_____

STATE OF MARYLAND
JASON AZAR
No. 31168
REGISTERED
PROFESSIONAL ENGINEER
5/16-17

**BY**

**NOBIS ENGINEERING, INC.**

(301) 528-2010
www.nobiseng.com

**Nobis Project No. 91140.04**
**APRIL 28, 2017**

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Engineering a Sustainable Future

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**SAFE ROUTES TO SCHOOL**
**GARRETT PARK, MARYLAND**

**SECTION**

I.

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## I.

The tration (MSHA) as part of the MSHA's Safe Routes to School program to install new sidewalks and repair the existing sidewalks within the town's limits to increase safety for pedestrians in various locations throughout the town.

## II. Existing Conditions

The road network in the Town of Garrett Park is owned and maintained by the town, with the exception of Strathmore Avenue, which is owned by MSHA. Garrett Park is developed with single family homes, and the entire town has been declared an arboretum and a National Historic District. Most the streets have narrow rights-of-way which range from forty to fifty feet in width. Additionally, there is very little storm drainage infrastructure within the town and long stretches of roadways drain to very few inlets scattered around the town.

## III. Proposed Conditions

The Town is proposing to construct or reconstruct approximately 3500 linear feet of sidewalk within the town limits. The sidewalk will be built along three routes: along Kenilworth Ave and Montrose/Clermont Ave at the north side of town, and along Oxford Street along the south side of town. The portions along Montrose/Clermont Ave will be the replacement for existing sidewalk that has failed or is in such poor condition that it cannot be repaired. The existing sidewalk is 4' wide and the replacement will also be 4' wide. This replacement portion, which is the largest segment, is approximately 1575 linear feet. The segment along Kenilworth Ave is approximately 580 linear feet, and the portion along Oxford Street is approximately 1350 linear feet. Along with the sidewalk, new curb will be replaced or added to provide a vertical separation from the travel way to the sidewalk as a measure of safety for pedestrians.

All of the proposed improvements will be made within the existing town right-of-way, which in some locations is as narrow as 40 feet wide. The narrow width of right-of-way causes the sidewalk in some locations to be located immediately adjacent to the curb with no grass strip. Also, since tree preservation is of utmost importance to the town and to retain its historic character, the sidewalk has been designed with an alignment that has flowing curves to go around trees and to avoid tree disturbances to the greatest extent feasible while still providing a safe pedestrian route. The limits of disturbance have also been minimized to only what is necessary to construct the sidewalk and curb to limit root impacts to trees within the town limits. There is no storm drainage work proposed with this project and the current drainage patterns are proposed to be maintained.

## IV. Stormwater Management

The limits of disturbance defined by the above constraints were used to compute the required ESDv for the project. It should be noted that the portion of the work along Montrose/Clermont Ave has been excluded from the computations since this work is being considered maintenance, as it pertains to the replacement of existing sidewalk. Below is a table of the computed ESDv for the balance of the project that contains the new sidewalk construction.

Table 1: ESDv Requirements Summary

| Study Point | (sf) | Impervious Area (sf) | | | (in) | ESDv Required (cf) |
|---|---|---|---|---|---|---|
| 1A Kenilworth Ave. (North) | 3,721 | 1,901 | 51% | 0.510 | 1.8 | 285 |
| 1B Kenilworth Ave. (South) | 4,878 | 2,438 | 50% | 0.500 | 1.8 | 366 |
| 2A Oxford Street (East) | 3,632 | 2,120 | 58% | 0.575 | 2.0 | 348 |
| 2B Oxford Street (West) | 13,672 | 7,104 | 52% | 0.518 | 1.8 | 1,062 |
| | | | | | Total | 2061 cf |

As discussed above, the entire town is considered an arboretum and tree preservation is of the utmost importance. The town also has poor infiltrating soils throughout the town with most soils falling in hydrologic groups C/D. An analysis was conducted for the entire project area in an effort to find any areas within the project limits that could support ESD facilities. Due to the limited space in the right-of-way, the poor soils, the steep slopes, lack of outfall for underdrains, the need to preserve trees, and the linear nature of this project, it was determined that there are no areas within the project limits that would feasibility support the construction of an ESD facility.

After the project area was analyzed, we looked for other areas within the town limits where compensatory treatment could possibly be provided. It was determined that no suitable locations existed along roadways not included in this project or in town owned parcels. No feasible alternatives were identified that could be included in this project.

Upon completion of the analysis of the remainder of the town parcels, it was discussed with Town officials that there are some existing drainage issues related to erosion within the town, specifically on a parcel of land owned by the town called Porcupine Woods, which is a park. There exist some drainage courses within the park that pick-up storm runoff from part of the town's limited closed storm drain system. As allowed in the MDE manual, stream restoration projects can be credited toward stormwater management requirements. In light of the numerous limitations within the project limits, the town determined the best ecological approach overall for the project and the Town would be provide for channel stabilization on a drainage course that is near to the sidewalk construction project on Clermont Avenue.

## V. Stream Restoration

In lie s and limita ɔration component at a drainage course within Porcupine Woods. The existing storm drain outfall is severely eroded as shown in the photos below.

*Existing 30" RCP outfall with no headwall and eroded bank on left*

*Existing drainage course exhibiting erosion*

Based on the visual observations, the erosion at the existing drainage course is currently causing downstream issues. The erosion at this location is flowing downstream to a culvert, located under the CSX Railroad, which is clogged with sediment and debris. This downstream culvert blockage causes portions of Porcupine Woods to become inundated with water for periods of time after rain

event land a

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owned

The proposed stream restoration would include approximately 70 linear feet of bank stabilization, the addition of 2 or 3 rock sills to control the channel grade and prevent erosion of the channel bed and the addition of a headwall with rip rap at the existing RCP pipe outfall. A cost estimate for the stream restoration work is included in section 4 of this report. For comparison, the stream restoration project costs are well in excess of what the SWM waiver fee would have been if a waiver had been pursued.

## VI. Conclusions

Due to the site constraints mentioned above along the roadways within the road, the existing developed nature of the town and the location of the stream restoration component adjacent to the sidewalk project, the Town believes that project has been designed to enhance and provide the best ecological benefit that is possible with this type of linear project.

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# II. ESD COMPUTATIONS

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**Project:**
**Project Number:** 91140.04
**Calculation:** Area Summary & ESDv Required Calculations

**Calculated by:** ME
**Reviewed by:** JA

**Property Area Summary for ESDv Computations**

| Study Point | Property Area (sf) | Total Post Development Impervious Area (sf) | % Impervious | Rv | HSG Areas | | | Target Pe (in) |
|---|---|---|---|---|---|---|---|---|
| | | | | | HSG | Area | Pe | |
| 1A Kenilworth Ave. (North) | 3,721 | 1,901 | 51.1% | 0.510 | B | 2,352 | 1.8 | 1.8 |
| | | | | | C | 1,369 | 1.8 | |
| 1B Kenilworth Ave. (South) | 4,878 | 2,438 | 50.0% | 0.500 | C | 4,878 | 1.8 | 1.8 |
| 2A Oxford Street (East) | 3,632 | 2,120 | 58.4% | 0.575 | B | 2,150 | 2.0 | 2.0 |
| | | | | | C | 1,484 | 2.0 | |
| 2B Oxford Street (West) | 13,672 | 7,104 | 52.0% | 0.518 | B | 11,405 | 1.8 | 1.8 |
| | | | | | C | 2,267 | 1.8 | |
| 3* Montrose/Clermont | 23,434 | 11,570 | 49.4% | 0.494 | B | 20,343 | 1.8 | 1.8 |
| | | | | | C | 3,091 | 1.8 | |

**Property Area Summary for ESDv Computations**

| Study Point | LOD Area (sf) | Total Post Development Impervious Area (sf) | % Impervious | Rv | Target Pe (in) | ESDv Required (cf) |
|---|---|---|---|---|---|---|
| 1A Kenilworth Ave. (North) | 3,721 | 1,901 | 51% | 0.510 | 1.8 | 285 |
| 1B Kenilworth Ave. (South) | 4,878 | 2,438 | 50% | 0.500 | 1.8 | 366 |
| 2A Oxford Street (East) | 3,632 | 2,120 | 58% | 0.575 | 2.0 | 348 |
| 2B Oxford Street (West) | 13,672 | 7,104 | 52% | 0.518 | 1.8 | 1,062 |
| 3* Montrose/Clermont | 23,434 | 11,570 | 49% | 0.494 | 1.8 | 1,738* |
| | | | | | **Total:** | **2,060** |

*Sidewalk and Curb Replacement Considered Maintenance within Study Point 3; Not Included in Stormwater Calculations

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52% IM
1.032 /
1.032 )

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FOR ALL OTHER LAND USE IMPERVIOUSNESS CONTRIBUTIONS MADE ON OR AFTER JULY 1, 1992

PERCENT (%) OF IMPERVIOUS

| | 0% | 1% | 2% | 3% | 4% | 5% | 6% | 7% | 8% | 9% |
|---|---|---|---|---|---|---|---|---|---|---|
| 0% | 0 | 90 | 180 | 270 | 360 | 450 | 540 | 630 | 720 | 810 |
| | 0 | 25 | 50 | 75 | 100 | 125 | 150 | 175 | 200 | 225 |
| | 0 | 115 | 230 | 345 | 460 | 575 | 690 | 805 | 920 | 1035 |
| 10% | 900 | 1030 | 1160 | 1290 | 1420 | 1550 | 1680 | 1810 | 1940 | 2070 |
| | 250 | 262 | 274 | 286 | 298 | 310 | 322 | 334 | 346 | 358 |
| | 1150 | 1292 | 1434 | 1576 | 1718 | 1860 | 2002 | 2144 | 1286 | 2428 |
| 20% | 2200 | 2330 | 2460 | 2590 | 2720 | 2850 | 2980 | 3110 | 3240 | 3370 |
| | 370 | 433 | 496 | 559 | 622 | 685 | 748 | 811 | 874 | 937 |
| | 2570 | 2763 | 2956 | 3149 | 3342 | 3535 | 3728 | 3921 | 4114 | 4307 |
| 30% | 3500 | 3600 | 3700 | 3800 | 3900 | 4000 | 4100 | 4200 | 4300 | 4400 |
| | 1000 | 1050 | 1100 | 1150 | 1200 | 1250 | 1300 | 1350 | 1400 | 1450 |
| | 4500 | 4650 | 4800 | 4950 | 5100 | 5250 | 5400 | 5550 | 5700 | 5850 |
| 40% | 4500 | 4650 | 4800 | 4950 | 5100 | 5250 | 5400 | 5550 | 5700 | 5850 |
| | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 | 2200 | 2300 | 2400 |
| | 6000 | 6250 | 6500 | 6750 | 7000 | 7250 | 7500 | 7750 | 8000 | 8250 |
| 50% | 6000 | 6300 | 6600 | 6900 | 7200 | 7500 | 7800 | 8100 | 8400 | 8700 |
| | 2500 | 2650 | 2800 | 2950 | 3100 | 3250 | 3400 | 3550 | 3700 | 3850 |
| | 8500 | 8950 | 9400 | 9850 | 10300 | 10750 | 11200 | 11650 | 12100 | 12550 |
| 60% | 9000 | 9600 | 10200 | 10800 | 11400 | 12000 | 12600 | 13200 | 13800 | 14400 |
| | 4000 | 4150 | 4300 | 4450 | 4600 | 4750 | 4900 | 5050 | 5200 | 5350 |
| | 13000 | 13750 | 14700 | 15250 | 16000 | 16750 | 17500 | 18250 | 19000 | 19750 |
| 70% | 15000 | 15750 | 16500 | 17250 | 18000 | 18750 | 19500 | 20250 | 21000 | 21750 |
| | 5500 | 5700 | 5900 | 6100 | 6300 | 6500 | 6700 | 6900 | 7100 | 7300 |
| | 20500 | 21450 | 22400 | 23350 | 24300 | 25250 | 26200 | 27150 | 28100 | 29050 |
| 80% | 22500 | 23550 | 24600 | 25650 | 26700 | 27750 | 28800 | 29850 | 30900 | 31950 |
| | 7500 | 7600 | 7700 | 7800 | 7900 | 8000 | 8100 | 8200 | 8300 | 8400 |
| | 30000 | 31150 | 32300 | 33450 | 34600 | 35750 | 36900 | 38050 | 39200 | 40350 |
| 90% | 33000 | 34200 | 35400 | 36600 | 37800 | 39000 | 40200 | 41400 | 42600 | 43800 |
| | 8500 | 8650 | 8800 | 8950 | 9100 | 9250 | 9400 | 9550 | 9700 | 9850 |
| | 41500 | 42850 | 44200 | 45550 | 46900 | 48250 | 49600 | 50950 | 52300 | 53650 |
| 100 % | 45000 | | | | | | | | | |
| | 10000 | | | | | | | | | |
| | 55000 | | | | | | | | | |

KEY

| |
|---|
| QN |
| QL |
| TOTAL |

JRB:sm:SWMFEE4

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# IV. STREAM RESTORATION COST ESTIMATE

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Project: Safe Routes to School - Town of Garrett Park
Description Engineer's Cost Estimate
Job Number 91140.04
Calculated by: JA
Checked by: JA
Date: 28-Apr-17

| | Item | Unit | Unit Cost | Quantity | Total Cost |
|---|---|---|---|---|---|
| **Stream Restoration** | Construction Access | LS | $2,500 | 1 | $2,500 |
| | Endwall | EA | $7,500 | 1 | $7,500 |
| | Rip Rap | LS | $3,000 | 1 | $3,000 |
| | Bank stablization | LF | $150 | 70 | $10,500 |
| | Tree Replacement | LS | $5,000 | 1 | $5,000 |
| | Rock Sills | EA | $2,000 | 1 | $2,000 |
| | Stabilization/Restoration | LS | $2,500 | 1 | $2,500 |
| | | | **SUBTOTAL** | | $33,000 |
| | | | **TOTAL COST** | | **$33,000.00** |


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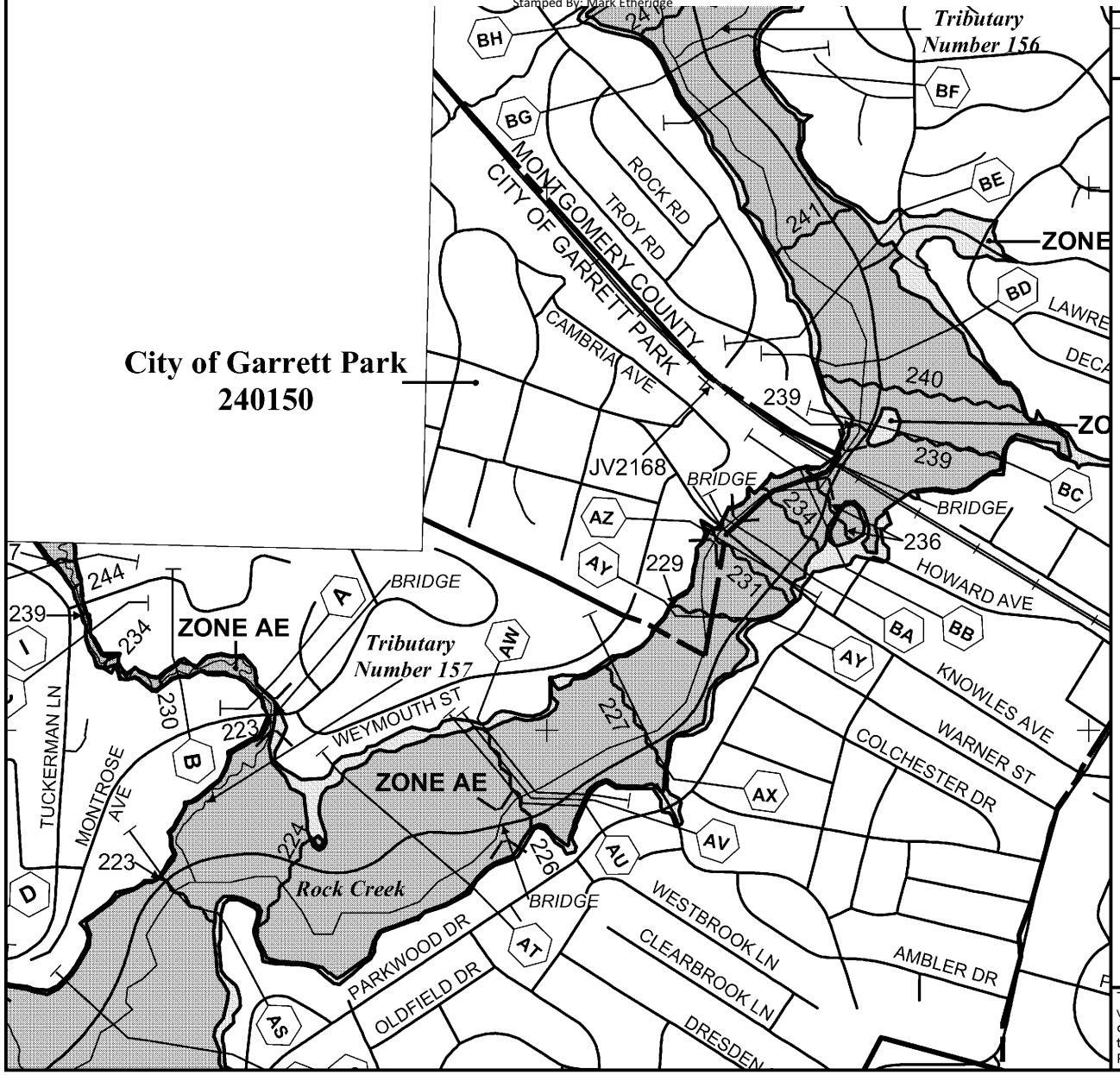
MAP SCALE 1" = 1000'
0 1000 2000
FEET
METERS




NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0365D

# FIRM

## FLOOD INSURANCE RATE MAP

## MONTGOMERY COUNTY, MARYLAND

### AND INCORPORATED AREAS

### PANEL 365 OF 480

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| CHEVY CHASE VIEW, TOWN OF | 240132 | 0365 | D |
| GARRETT PARK, CITY OF | 240150 | 0365 | D |
| KENSINGTON, TOWN OF | 240119 | 0365 | D |
| MONTGOMERY COUNTY | 240049 | 0365 | D |
| NORTH CHEVY CHASE, TOWN OF | 240129 | 0365 | D |

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**
**24031C0365D**

**EFFECTIVE DATE**
**SEPTEMBER 29, 2006**

**Federal Emergency Management Agency**

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

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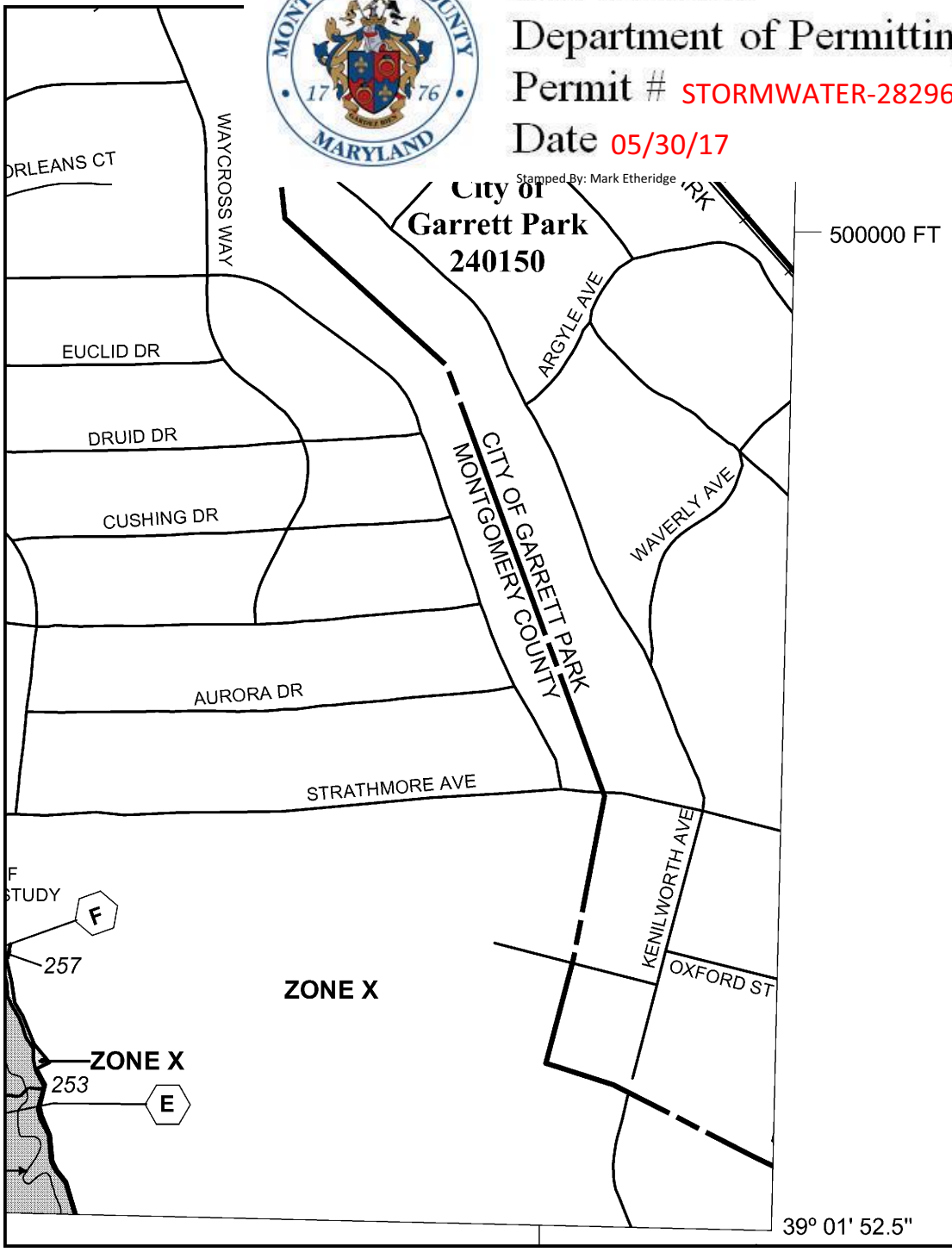


MAP SCALE 1" = 500'

0 500 1000 FEET

METERS

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0361D

# FIRM

## FLOOD INSURANCE RATE MAP

## MONTGOMERY COUNTY, MARYLAND

### AND INCORPORATED AREAS

### PANEL 361 OF 480

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| GARRETT PARK, CITY OF | 240150 | 0361 | D |
| MONTGOMERY COUNTY | 240049 | 0361 | D |
| ROCKVILLE, CITY OF | 240051 | 0361 | D |

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**
**24031C0361D**

**EFFECTIVE DATE**
**SEPTEMBER 29, 2006**

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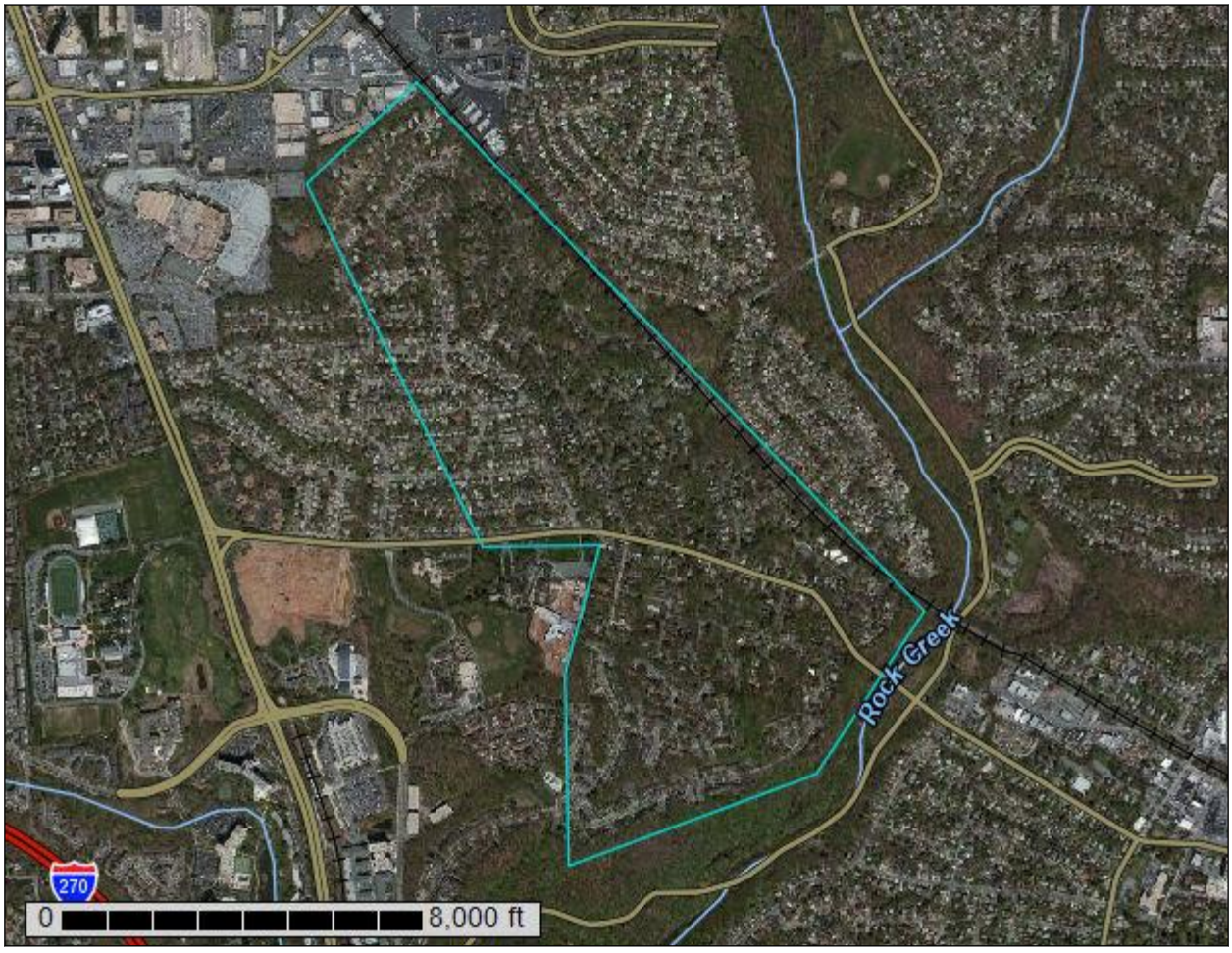
Natural Resources Conservation Service

agencies including the Agricultural Experiment Stations, and local participants

# County, Maryland




February 23, 2017

# Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

# Contents

# How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and


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# Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

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Map Scale: 1:12,200 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 150 300 600 900

Feet
0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

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Department of Permitting Services
Permit # STORMWATER-282967
Date 05/30/17
Stamped By: Mark Etheridge

**Area of Interest (AOI)**

- Area of Interest (AOI)

**Soils**

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

**Special Point Features**

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

**Water Features**

- Streams and Canals

**Transportation**

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

**Background**

- Aerial Photography

## AP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Montgomery County, Maryland
Survey Area Data: Version 12, Sep 20, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

| Montgomery County, Maryland (MD031) | | | |
|---|---|---|---|
| **Map Unit Symbol** | **Map Unit Name** | **Acres in AOI** | **Percent of AOI** |
| 2B | Glenelg silt loam, 3 to 8 percent slopes | 77.2 | 24.6% |
| 2C | Glenelg silt loam, 8 to 15 percent slopes | 126.4 | 40.3% |
| 2UB | Glenelg-Urban land complex, 0 to 8 percent slopes | 54.0 | 17.2% |
| 2UC | Glenelg-Urban land complex, 8 to 15 percent slopes | 38.8 | 12.4% |
| 6A | Baile silt loam, 0 to 3 percent slopes | 2.7 | 0.9% |
| 16D | Brinklow-Blocktown channery silt loams, 15 to 25 percent slopes | 13.3 | 4.2% |
| 53A | Codorus silt loam, 0 to 3 percent slopes, occasionally flooded | 0.9 | 0.3% |
| 116E | Blocktown channery silt loam, 25 to 45 percent slopes, very rocky | 0.6 | 0.2% |
| 400 | Urban land | 0.0 | 0.0% |
| **Totals for Area of Interest** | | **314.1** | **100.0%** |

# Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties

scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.


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**Map Unit Setting**

*National map unit symbol:* 2v7gr
*Elevation:* 30 to 1,200 feet
*Mean annual precipitation:* 40 to 55 inches
*Mean annual air temperature:* 48 to 57 degrees F
*Frost-free period:* 150 to 192 days
*Farmland classification:* All areas are prime farmland

**Map Unit Composition**

*Glenelg and similar soils:* 85 percent
*Minor components:* 15 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Glenelg**

**Setting**

*Landform:* Interfluves, hillslopes
*Landform position (two-dimensional):* Summit, shoulder, backslope
*Landform position (three-dimensional):* Interfluve, side slope
*Down-slope shape:* Linear
*Across-slope shape:* Linear, concave, convex
*Parent material:* Residuum weathered from mica schist

**Typical profile**

*Ap - 0 to 8 inches:* silt loam
*Bt1 - 8 to 18 inches:* clay loam
*Bt2 - 18 to 30 inches:* clay loam
*BCt - 30 to 42 inches:* loam
*CBt - 42 to 54 inches:* loam
*C - 54 to 76 inches:* channery fine sandy loam

**Properties and qualities**

*Slope:* 3 to 8 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Well drained
*Runoff class:* Medium
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.57 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* High (about 10.4 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2e
*Hydrologic Soil Group:* C
*Hydric soil rating:* No

*Percent of map unit:* 10 percent
*Landform:* Ridges, hillslopes
*Landform position (two-dimensional):* Backslope, shoulder
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Hydric soil rating:* No

**Glenville**

*Percent of map unit:* 5 percent
*Landform:* Swales, drainageways
*Landform position (two-dimensional):* Shoulder, backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Concave
*Across-slope shape:* Linear
*Hydric soil rating:* No

## 2C—Glenelg silt loam, 8 to 15 percent slopes

### Map Unit Setting

*National map unit symbol:* 2tt89
*Elevation:* 30 to 1,200 feet
*Mean annual precipitation:* 40 to 55 inches
*Mean annual air temperature:* 48 to 57 degrees F
*Frost-free period:* 150 to 192 days
*Farmland classification:* Farmland of statewide importance

### Map Unit Composition

*Glenelg and similar soils:* 85 percent
*Minor components:* 15 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Glenelg

#### Setting

*Landform:* Interfluves, hillslopes
*Landform position (two-dimensional):* Summit, shoulder, backslope
*Landform position (three-dimensional):* Interfluve, side slope
*Down-slope shape:* Linear
*Across-slope shape:* Linear, concave, convex
*Parent material:* Residuum weathered from mica schist

#### Typical profile

*Ap - 0 to 8 inches:* silt loam
*Bt1 - 8 to 18 inches:* clay loam
*Bt2 - 18 to 30 inches:* clay loam
*BCt - 30 to 42 inches:* loam

*Slope:* 8 to 15 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Well drained
*Runoff class:* Medium
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 1.98 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* High (about 10.4 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 3e
*Hydrologic Soil Group:* B
*Hydric soil rating:* No

**Minor Components**

**Gaila**

*Percent of map unit:* 10 percent
*Landform:* Ridges, hillslopes
*Landform position (two-dimensional):* Backslope, shoulder
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Hydric soil rating:* No

**Glenville**

*Percent of map unit:* 5 percent
*Landform:* Swales, drainageways
*Landform position (two-dimensional):* Shoulder, backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Concave
*Across-slope shape:* Linear
*Hydric soil rating:* No

## 2UB—Glenelg-Urban land complex, 0 to 8 percent slopes

**Map Unit Setting**

*National map unit symbol:* kx8p
*Elevation:* 250 to 1,050 feet
*Mean annual precipitation:* 40 to 55 inches
*Mean annual air temperature:* 45 to 61 degrees F
*Frost-free period:* 110 to 235 days
*Farmland classification:* Not prime farmland

*Urban land:* 35 percent
*Minor components:* 20 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Glenelg**

**Setting**

*Landform:* Interfluves, hillslopes
*Landform position (two-dimensional):* Summit, shoulder, backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Parent material:* Loamy residuum weathered from phyllite

**Typical profile**

*Ap - 0 to 10 inches:* loam
*Bt1,Bt2,BCt1 - 10 to 30 inches:* clay loam
*BCt2, CBt - 30 to 54 inches:* loam
*C - 54 to 76 inches:* very channery sandy loam

**Properties and qualities**

*Slope:* 0 to 8 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Well drained
*Runoff class:* Medium
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.20 to 1.98 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* High (about 10.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2e
*Hydrologic Soil Group:* B
*Hydric soil rating:* No

**Description of Urban Land**

**Setting**

*Parent material:* Human transported material

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 8
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

**Minor Components**

**Udorthents**

*Percent of map unit:* 15 percent
*Landform:* Ridges
*Landform position (two-dimensional):* Backslope, shoulder, summit

*Hydric soil rating:* No

**Glenville**

*Percent of map unit:* 5 percent
*Landform:* Swales, drainageways
*Landform position (three-dimensional):* Base slope, head slope
*Down-slope shape:* Concave
*Across-slope shape:* Linear
*Hydric soil rating:* No

## 2UC—Glenelg-Urban land complex, 8 to 15 percent slopes

**Map Unit Setting**

*National map unit symbol:* kx8q
*Elevation:* 250 to 1,050 feet
*Mean annual precipitation:* 37 to 55 inches
*Mean annual air temperature:* 45 to 61 degrees F
*Frost-free period:* 110 to 235 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Glenelg and similar soils:* 45 percent
*Urban land:* 30 percent
*Minor components:* 25 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Glenelg**

**Setting**

*Landform:* Interfluves, hillslopes
*Landform position (two-dimensional):* Summit, shoulder, backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Convex
*Across-slope shape:* Linear

**Typical profile**

*Ap - 0 to 10 inches:* loam
*Bt1,Bt2,BCt1 - 10 to 30 inches:* clay loam
*BCt2, CBt - 30 to 54 inches:* loam
*C - 54 to 76 inches:* very channery sandy loam

**Properties and qualities**

*Slope:* 8 to 15 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Well drained
*Runoff class:* Medium

h to

*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* High (about 10.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 3e
*Hydrologic Soil Group:* B
*Hydric soil rating:* No

**Description of Urban Land**

**Setting**

*Parent material:* Human transported material

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 8
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

**Minor Components**

**Udorthents**

*Percent of map unit:* 15 percent
*Landform:* Ridges
*Landform position (two-dimensional):* Backslope, shoulder, summit
*Landform position (three-dimensional):* Side slope, nose slope, interfluve
*Down-slope shape:* Convex, linear
*Across-slope shape:* Convex, linear
*Hydric soil rating:* No

**Manor**

*Percent of map unit:* 10 percent
*Landform:* Ridges, hillslopes
*Landform position (two-dimensional):* Backslope, shoulder
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Hydric soil rating:* No

## 6A—Baile silt loam, 0 to 3 percent slopes

**Map Unit Setting**

*National map unit symbol:* kxb9
*Elevation:* 250 to 980 feet
*Mean annual precipitation:* 35 to 50 inches

**Map Unit Composition**

*Baile and similar soils:* 85 percent
*Minor components:* 15 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Baile**

**Setting**

*Landform:* Depressions, swales, drainageways, hillslopes
*Landform position (three-dimensional):* Head slope, base slope
*Down-slope shape:* Concave
*Across-slope shape:* Concave, linear

**Typical profile**

*A - 0 to 9 inches:* silt loam
*Btg - 9 to 32 inches:* silty clay loam
*Cg - 32 to 65 inches:* loam

**Properties and qualities**

*Slope:* 0 to 3 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Poorly drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
*Depth to water table:* About 0 to 6 inches
*Frequency of flooding:* None
*Frequency of ponding:* Frequent
*Available water storage in profile:* High (about 10.8 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 4w
*Hydrologic Soil Group:* C/D
*Hydric soil rating:* Yes

**Minor Components**

**Glenville**

*Percent of map unit:* 15 percent
*Landform:* Swales, drainageways
*Landform position (three-dimensional):* Base slope, head slope
*Down-slope shape:* Concave
*Across-slope shape:* Linear
*Hydric soil rating:* No

## 16D—Brinklow-Blocktown channery silt loams, 15 to 25 percent slopes

### Map Unit Setting

*National map unit symbol:* kx79
*Elevation:* 300 to 2,000 feet
*Mean annual precipitation:* 7 to 55 inches
*Mean annual air temperature:* 45 to 61 degrees F
*Frost-free period:* 110 to 240 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Brinklow and similar soils:* 50 percent
*Blocktown and similar soils:* 30 percent
*Minor components:* 20 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Brinklow

#### Setting

*Landform:* Knolls
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Parent material:* Gravelly residuum weathered from low base phyllites and schists.

#### Typical profile

*Ap - 0 to 10 inches:* channery silt loam
*Bt,BC - 10 to 25 inches:* channery loam
*Cr - 25 to 35 inches:* bedrock
*R - 35 to 39 inches:* bedrock

#### Properties and qualities

*Slope:* 15 to 25 percent
*Depth to restrictive feature:* 20 to 40 inches to lithic bedrock
*Natural drainage class:* Well drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Very low (0.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* Low (about 4.0 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* C
*Hydric soil rating:* No

*Landform:* Knolls
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Parent material:* Gravelly residuum weathered from low base phyllites and schists.

**Typical profile**

*Ap - 0 to 6 inches:* channery silt loam
*Bt - 6 to 17 inches:* extremely channery silt loam
*Cr - 17 to 21 inches:* bedrock
*R - 21 to 25 inches:* bedrock

**Properties and qualities**

*Slope:* 15 to 25 percent
*Depth to restrictive feature:* 10 to 20 inches to paralithic bedrock
*Natural drainage class:* Well drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Very low (0.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* Very low (about 1.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

**Minor Components**

**Glenelg**

*Percent of map unit:* 10 percent
*Hydric soil rating:* No

**Baile**

*Percent of map unit:* 5 percent
*Landform:* Flats
*Hydric soil rating:* Yes

**Occoquan**

*Percent of map unit:* 5 percent
*Hydric soil rating:* No

## 53A—Codorus silt loam, 0 to 3 percent slopes, occasionally flooded

**Map Unit Setting**

*National map unit symbol:* kx9d

*Frost-free period:* 140 to 200 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Codorus and similar soils:* 85 percent
*Minor components:* 15 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Codorus**

**Setting**

*Landform:* Flood plains
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Loamy alluvium derived from phyllite, schist, diabase and/or greenstone

**Typical profile**

*Ap - 0 to 11 inches:* silt loam
*Bw1 - 11 to 18 inches:* silt loam
*Bw2 - 18 to 40 inches:* gravelly silt loam
*2C - 40 to 60 inches:* stratified sand to very gravelly loam

**Properties and qualities**

*Slope:* 0 to 3 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Moderately well drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.57 in/hr)
*Depth to water table:* About 18 to 30 inches
*Frequency of flooding:* Occasional
*Frequency of ponding:* None
*Available water storage in profile:* High (about 9.6 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2w
*Hydrologic Soil Group:* C
*Hydric soil rating:* No

**Minor Components**

**Hatboro**

*Percent of map unit:* 15 percent
*Landform:* Flood plains
*Down-slope shape:* Concave
*Across-slope shape:* Linear
*Hydric soil rating:* Yes

## 116E—Blocktown channery silt loam, 25 to 45 percent slopes, very rocky

### Map Unit Setting

*National map unit symbol:* kx76
*Elevation:* 330 to 2,000 feet
*Mean annual precipitation:* 7 to 50 inches
*Mean annual air temperature:* 45 to 57 degrees F
*Frost-free period:* 120 to 240 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Blocktown and similar soils:* 85 percent
*Minor components:* 15 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Blocktown

#### Setting

*Landform:* Knolls
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Parent material:* Gravelly residuum weathered from low base phyllites and schists.

#### Typical profile

*Ap - 0 to 6 inches:* channery silt loam
*Bt - 6 to 17 inches:* extremely channery silt loam
*Cr - 17 to 21 inches:* bedrock
*R - 21 to 25 inches:* bedrock

#### Properties and qualities

*Slope:* 25 to 45 percent
*Depth to restrictive feature:* 10 to 20 inches to paralithic bedrock
*Natural drainage class:* Well drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Very low (0.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* Very low (about 1.7 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7e
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

*Percent of map unit:* 10 percent
*Hydric soil rating:* No

**Baile**

*Percent of map unit:* 5 percent
*Landform:* Flats
*Hydric soil rating:* Yes

## 400—Urban land

### Map Unit Setting

*National map unit symbol:* kx8y
*Elevation:* 300 to 900 feet
*Mean annual precipitation:* 42 to 48 inches
*Mean annual air temperature:* 50 to 57 degrees F
*Frost-free period:* 160 to 220 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Urban land:* 85 percent
*Minor components:* 15 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Urban Land

#### Setting

*Parent material:* Human transported material

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 8
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

### Minor Components

#### Udorthents

*Percent of map unit:* 15 percent
*Hydric soil rating:* No

# Soil Information for All Uses

## Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

## Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

### Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

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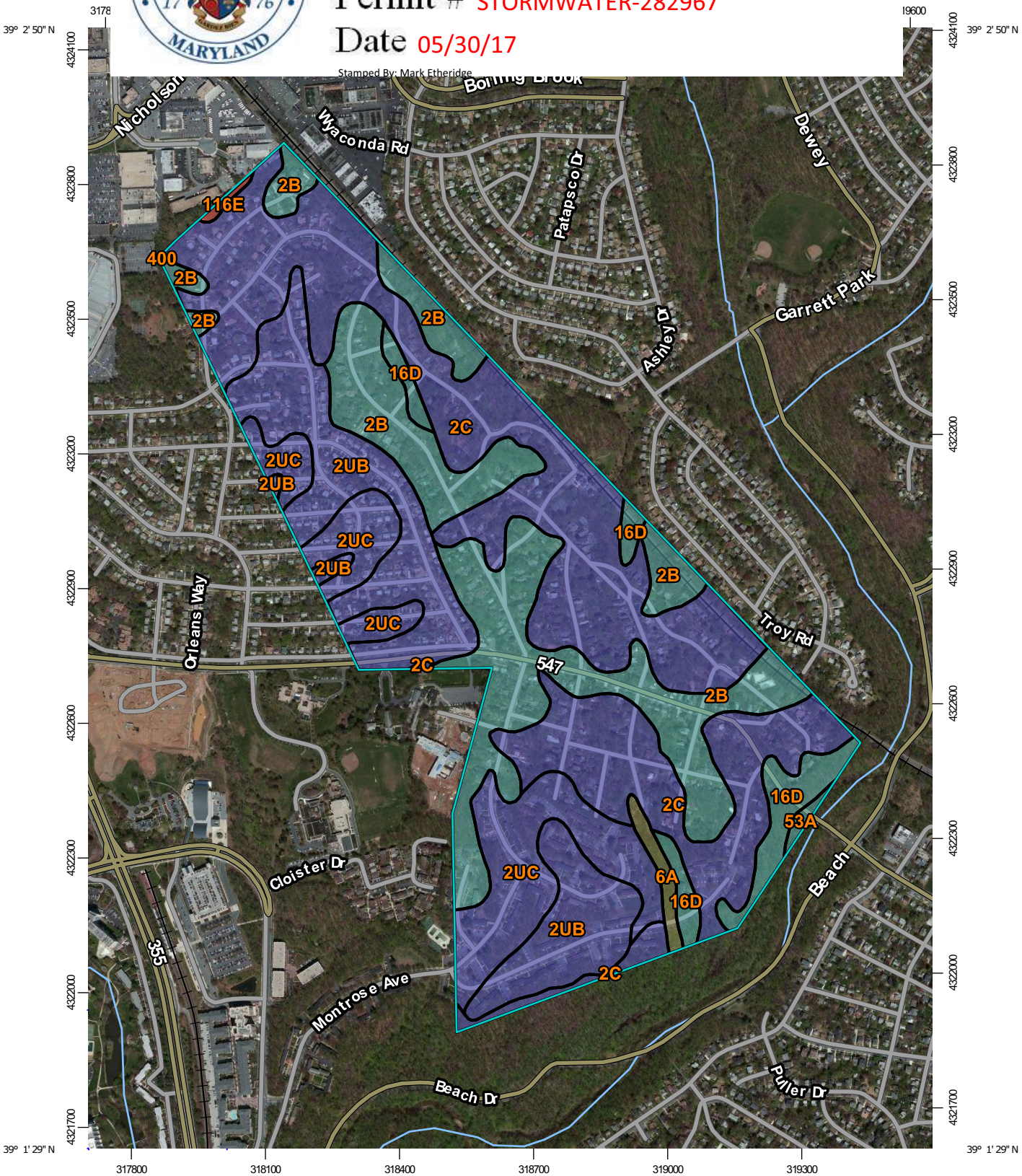
Department of Permitting Services
Permit # STORMWATER-282967
Date 05/30/17
Stamped By: Mark Etheridge




Map Scale: 1:12,200 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

APPROVED
Department of Permitting Services
Permit # STORMWATER-282967
Date 05/30/17
Stamped By: Mark Etheridge

**Area of Interest (AOI)**

- Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Soil Rating Lines**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Soil Rating Points**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Water Features**

- Streams and Canals

**Transportation**

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

**Background**

- Aerial Photography

## AP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Montgomery County, Maryland
Survey Area Data: Version 12, Sep 20, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

| Hydrologic Soil Group— Summary by Map Unit — Montgomery County, Maryland (MD031) | | | | |
|---|---|---|---|---|
| **Map unit symbol** | **Map unit name** | **Rating** | **Acres in AOI** | **Percent of AOI** |
| 2B | Glenelg silt loam, 3 to 8 percent slopes | C | 77.2 | 24.6% |
| 2C | Glenelg silt loam, 8 to 15 percent slopes | B | 126.4 | 40.3% |
| 2UB | Glenelg-Urban land complex, 0 to 8 percent slopes | B | 54.0 | 17.2% |
| 2UC | Glenelg-Urban land complex, 8 to 15 percent slopes | B | 38.8 | 12.4% |
| 6A | Baile silt loam, 0 to 3 percent slopes | C/D | 2.7 | 0.9% |
| 16D | Brinklow-Blocktown channery silt loams, 15 to 25 percent slopes | C | 13.3 | 4.2% |
| 53A | Codorus silt loam, 0 to 3 percent slopes, occasionally flooded | C | 0.9 | 0.3% |
| 116E | Blocktown channery silt loam, 25 to 45 percent slopes, very rocky | D | 0.6 | 0.2% |
| 400 | Urban land | D | 0.0 | 0.0% |
| **Totals for Area of Interest** | | | **314.1** | **100.0%** |

## Rating Options—Hydrologic Soil Group

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff: None Specified*

*Tie-break Rule:* Higher

# References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf